MicroNode I/O™

DeviceNet AI

User Manual

Control & Information Technology Group
70 Rio Robles Drive
San Jose, CA 95134

Main: 408.750.0300
Fax: 408.750.2990

Rev. 02
11/05

Copyright

70 Rio Robles Drive
San Jose, CA 95134

Preface

About this manual

This manual is designed to serve as a guideline for the installation, setup, operation and basic maintenance of the MicroNode device. The information contained within this manual, including product specifications, is subject to change without notice. Please observe all safety precautions and use appropriate procedures when handling the MicroNode product and its related software.

Table of Contents

1 General Information

The MicroNode I/O™ product line provides high-density, compact, and economical I/O solutions for popular Fieldbus Networks. The MicroNode AI provides 16 analog inputs to a DeviceNet™ network. The MicroNode package provides flexible side or foot mounting and easy access to I/O through a standard 37-pin D-Sub connector. All physical and object model features are ODVA Semi SIG compliant.

AS00107-01	MicroNode I/O, DeviceNet, 16 AI, side
AS00108-01	MicroNode I/O, DeviceNet, 16 AI, front

1.1 Conventions used in this User Manual

Warning — **The WARNING sign denotes a hazard to personnel. It calls attention to a procedure, practice, condition, or the like, which, if not correctly performed or adhered to, could result in injury to personnel.**

Caution — **The CAUTION sign higlights information that is important to the safe operation of the BlueBox, or to the integrity of your files. .**

Note — **THE NOTE SIGN DENOTES IMPORTANT INFORMATION. IT CALLS ATTENTION TO A PROCEDURE, PRACTICE, CONDITION, OR THE LIKE, WHICH IS ESSENTIAL TO HIGHLIGHT.**

On screen buttons or menu items appear in bold and cursive.
Example: Click ***OK*** to save the settings.

Keyboard keys appear in brackets.
Example: [ENTER] and [CTRL]

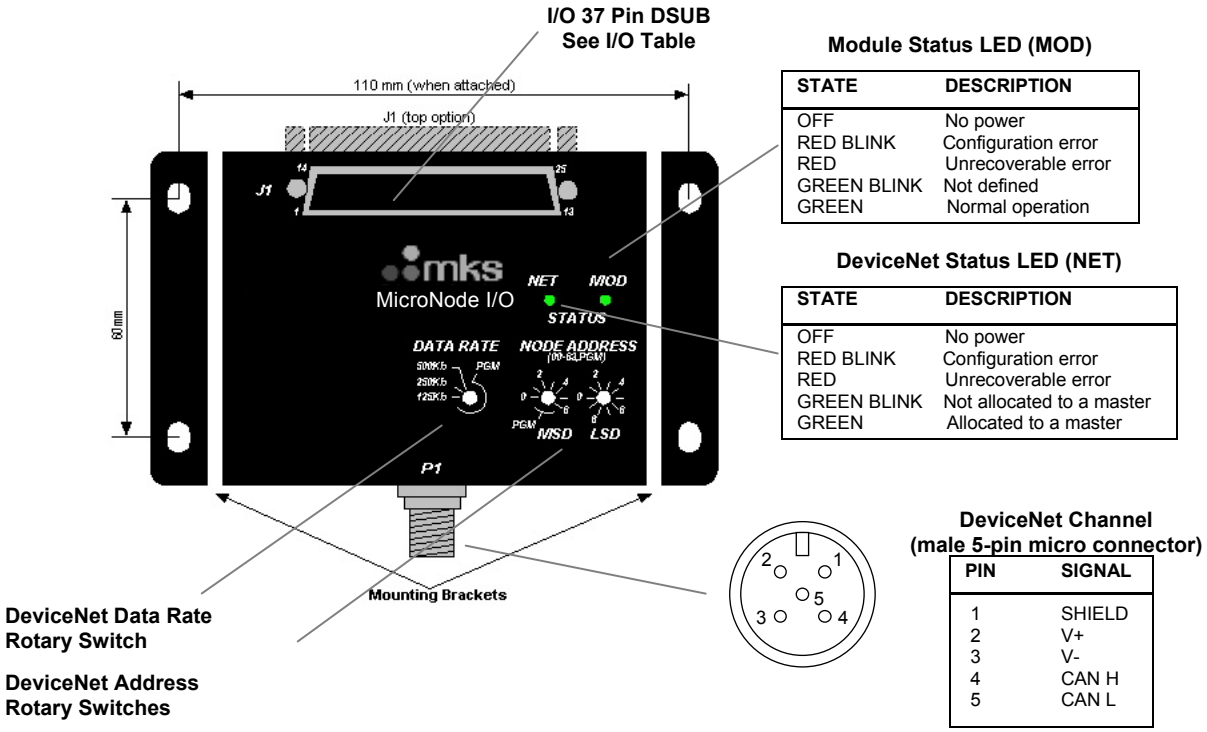
Pages with additional information about a specific topic are cross-referenced within the text.
Example: (See page xxx)

2 Installation and Setup

2.1 Shipping Box Contents

- MicroNode Product

2.2 MicroNode Hardware Description



Module Status LED (MOD)

STATE	DESCRIPTION
OFF	No power
RED BLINK	Configuration error
RED	Unrecoverable error
GREEN BLINK	Not defined
GREEN	Normal operation

DeviceNet Status LED (NET)

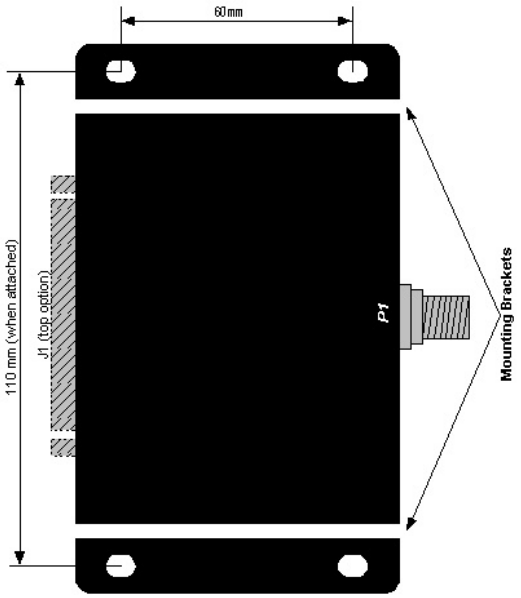
STATE	DESCRIPTION
OFF	No power
RED BLINK	Configuration error
RED	Unrecoverable error
GREEN BLINK	Not allocated to a master
GREEN	Allocated to a master

DeviceNet Channel
(male 5-pin micro connector)

PIN	SIGNAL
1	SHIELD
2	V+
3	V-
4	CAN H
5	CAN L

2.3 Installation

Mount the MicroNode on a horizontal or vertical surface, in a suitable location or enclosure for your application. Provide sufficient clearance and airflow to maintain 0°C to 55°C ambient operating temperature range. Fasten the unit to the mounting surface using four screws (not provided) in the 4mm wide mounting holes.



Height of 31mm,
not including D-Sub 37 connector

Note **ALL DIMENSIONS ARE METRIC**

2.4 Wiring

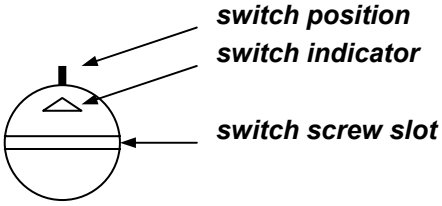
The MicroNode requires two connections – one to the DeviceNet network (male 5-pin micro connector) and one to the 37-pin D-SUB. DeviceNet™ and I/O cables are available from a variety of industrial sources. See table below for orderable I/O mating connectors.

Description	Distributor	Part Number
37-pin D-SUB Plug (solder cup)	Mouser	523-17D-C37P
37-pin D-SUB metal hood	Mouser	523-17-1727-2

Warning **Follow all applicable electrical codes in your area when mounting and wiring any electrical device.**

2.5 Rotary Switches

Set the rotary switches to the desired settings. Use a small slotted screwdriver to rotate the switches. Align the indicator arrow to the desired setting, as shown below.



Each rotary switch parameter has a **PGM** option. Setting a switch to PGM allows the parameter to be remotely set over DeviceNet. However, it must first be initialized. To initialize, set the switch to desired value and power up the unit. The new settings are saved in its memory. Power down and change switch to PGM mode.

2.6 Configuration

Rotary switches and software parameters are used to configure the MicroNode's *DeviceNet Interface* and I/O functions. The MicroNode is configured over DeviceNet. Use your DeviceNet configuration program and the MicroNode EDS file to set the software parameters over the DeviceNet channel.

2.6.1 Power Supply Wiring

All network circuits and the analog circuits are powered from DeviceNet. Select your DeviceNet cables and power supply so that it can provide sufficient current for all networked devices at their peak operating power.

2.6.2 I/O Wiring

The MicroNode has a female 37-pin D-Sub for I/O. The pinout is shown in the following table.

I/O Pinout

AI Model Connector			
Pin	**Signal**	**Pin**	**Signal**
1	AI0	20	A GND
2	A GND	21	AI10
3	AI1	22	A GND
4	A GND	23	AI11
5	AI2	24	A GND
6	A GND	25	AI12
7	AI3	26	A GND
8	A GND	27	AI13
9	AI4	28	A GND
10	A GND	29	AI14
11	AI5	30	A GND
12	A GND	31	AI15
13	AI6	32	A GND
14	A GND	33	N.C.
15	AI7	34	Dnet V+ out
16	A GND	35	Dnet V+ out
17	AI8	36	Dnet V- out
18	A GND	37	Dnet V- out
19	AI9		

3 Quick-Start

This chapter describes the setup for a simple system using a DeviceNet master and a MicroNode module. Before beginning, a basic understanding of DeviceNet is recommended. Experience using explicit and poll transactions from the software provided with your DeviceNet master is essential. For more information on generating explicit and poll messages consult the DeviceNet master's user's guide.

3.1 Hardware Setup

Setup a connection between a DeviceNet master and the MicroNode.

Required Hardware:

- DeviceNet cable
- DeviceNet master
- Power supply
- Voltage reference

3.2 Configuring the MicroNode

The major steps for configuring the MicroNode include setting up the DeviceNet I/O Objects.

Configure the MicroNode switches as follows:

- MACID MSD to 0
- MACID LSD to 1
- DeviceNet Data rate to 500K

Once all of the hardware is setup and powered, make sure that the master can allocate both poll and explicit connections to the MicroNode. Once allocated, both the NET and MOD LED will be solid green.

Warning **At this point, if the network and module LEDs on both the master and MicroNode are not solid green, do not proceed. Ensure the master baud rate matches the switch on the MicroNode, and that the MicroNode has a node address that is not used by another node on the network.**

3.3 Enabling the I/O

Configure a voltage reference (set between 0 – 10 V) and connect to an AI point (see connector pinout on section 2.6.2). Use Explicit Messaging to read the analog input and verify the input is reading your voltage reference through the network.

4 Theory of Operation

This chapter describes how the MicroNode operates. Working knowledge of DeviceNet is required before continuing. The Open DeviceNet Vendors Association (www.odva.com) is a good source for general DeviceNet information.

4.1 DeviceNet Interface

The DeviceNet Specification defines an Object Model that consists of Objects and Attributes. An Object is a predefined software process, and an Object Attribute is a data value used or created by that process. An Object can have multiple Instances, or the same process operating with different sets of Attributes or data values. For the purpose of this document, an Object Instance is an independent program or process, and its Attributes are configuration parameters and data values that are unique to that specific Object Instance.

The MicroNode has eleven different Object Classes, or types. Five are standard objects defined by the DeviceNet Specification (*Identity, Router, DeviceNet, Assembly, Connection*). Other specific objects defined for the MicroNode include (*Discrete Analog Input, Supervisory Object, User Defined Configuration Object)*.

The MicroNode operates as a DeviceNet slave. It supports Explicit Messages and Polled I/O Messages of the predefined master/slave connection set. The Explicit Unconnected Message Manager (UCMM) is not supported. The MicroNode will be a Group 2 Only Slave device. It will support Polled I/O and Explicit Messaging. The DeviceNet interface complies with the DeviceNet Physical Layer specification.

4.1.1 Analog Inputs

The Analog inputs are coupled directly to the processor and are implemented using 12 bit A/D converters. This device supports software settable ranges of 0V-10V, and –5V to +5V.

All Analog circuitry is powered from an internal ± 15 Volt power source (1 Watt) derived from the 24 Volt DeviceNet power. The +15 and -15 VDC power is protected with a self-resetting poly fuse rated at 100 mA.

5 MicroNode Configuration

This chapter describes how to configure and operate the MicroNode. The MicroNode is configured by reading and writing attribute values over the DeviceNet interface. There are a variety of DeviceNet configuration tools available. Simple configuration tools use GET_ATTRIBUTE and SET_ATTRIBUTE explicit message commands to read and write attribute values, addressing each attribute by its *Object*, *Instance*, and *Attribute* numbers. More sophisticated configuration tools use electronic datasheet files to simplify attribute configuration.

5.1 Configure DeviceNet Interface

The DeviceNet Baud Rate and MAC ID Address are set using the rotary switches. Configure switches before connecting to the DeviceNet network. There is either a small triangular indicator or white indicator on the switch. Use a small screwdriver to align that indicator with the desired setting.

5.1.1 DeviceNet Baud Rate Switch

Valid settings are 125K, 250K, 500K, or PGM. When PGM is selected, the MicroNode uses the baud rate saved in its retentive memory. To save a valid baud rate in memory, set the switch to the desired baud rate and power up the MicroNode for a few seconds. Power down and set the switch to PGM. You may also write to the DeviceNet Object Baud Rate attribute.

POSITION	SETTING
0	125 Kbps
1	250 Kbps
2	500 Kbps

5.1.2 MAC ID Switches

The two MAC ID switches represent decimal numbers from 00 to 99. The LSB switch selects the *Ones* digit and the MSB switch selects the *Tens* digit. Valid MAC IDs are 00 to 63. Setting a MAC ID address greater than 63 forces the unit to use the MAC ID saved in retentive memory. To save a valid MAC ID in memory, set the switches to the desired MAC ID and power up the MICRONODE for a few seconds. Power down and set the switches to value greater than 63. You may also write to the DeviceNet Object MAC ID attribute.

MSB	LSB	Address	MSB	LSB	Address
0	0 to 9	00 to 09	6	4 to 9	stored address
1	0 to 9	10 to 19	7	0 to 3	stored address
2	0 to 9	20 to 29	8	0 to 9	stored address
3	0 to 9	30 to 39	9	0 to 9	stored address
4	0 to 9	40 to 49			
5	0 to 9	50 to 59			
6	0 to 3	60 to 63			

5.2 Power Up

Connect the DeviceNet network cable and I/O cable to power the MicroNode.

5.2.1 DeviceNet Status LEDs

The MicroNode has two bi-color status LEDs (*NET* and *MOD*) that indicate operational status. During power-up, the LEDs cycle through a sequence of alternating red and green. After power-up, the *NET* LED should be flashing green (or solid green if allocated to a DeviceNet master) and the *MOD* LED should be solid green. If this does not occur, disconnect from DeviceNet and verify all the switch settings.

State	DeviceNet Status LED (*NET*)
Off	No power.
Flashing Red	Configuration error. Check DeviceNet switch settings.
Solid Red	Unrecoverable error.
Flashing Green	Device not allocated to a DeviceNet master.
Solid Green	Normal runtime, device allocated as a slave.

State	Module Status LED (*MOD*)
Off	No power.
Flashing Red	Configuration error. Check object attribute settings.
Solid Red	Unrecoverable error.
Flashing Green	Not defined.
Solid Green	Normal Operation.

5.3 Register EDS File

If using a DeviceNet configuration tool that supports Electronic Data Sheet (EDS) files, the latest EDS file versions can be downloaded from *www.mksinst.com*. Select the EDS file that matches the part number and firmware version. Follow the configuration tool instructions to register EDS file.

5.4 Polled I/O Configuration

A polled connection to the analog MicroNode will be determined by the Assembly Object. See Section 6 of the manual for the default polled connection list.

6 DeviceNet Object Model

The analog MicroNode device operates as a slave on the DeviceNet network. The unit supports Explicit Messages and Polled I/O Messages of the predefined master/slave connection set. It does not support the Unconnected Message Manager (UCMM).

DeviceNet Message Types (Slave Receive)

As a group 2 slave device the Digital MicroNode supports the following received message types.

CAN IDENTIFIER	GROUP 2 Message Type
10xxxxxx100	Master Explicit Request Message
10xxxxxx101	Master I/O Poll Command Message
10xxxxxx110	Unconnected Explicit Request Message
10xxxxxx111	Duplicate MACID Check Message

xxxxxx = Node Address

DeviceNet Object Classes

The device supports the following DeviceNet object classes.

CLASS CODE	OBJECT TYPE
01 (0x01)	Identity
02 (0x02)	Router
03 (0x03)	DeviceNet
04 (0x04)	Assembly
05 (0x05)	Connection
010 (0x0A)	Analog Input Point
48 (0x30)	S-Device Supervisor
100 (0x64)	Configuration

6.1 Identity Object Class Code: 01 (0x01)

The Identity Object is required on all devices and provides identification of and general information about the device.

Table 1. Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max Instance	UINT	1

Table 2. Instance 1 Attributes

Attribute	Access	Name	Type	Value
1	Get	Vendor ID	UINT	664 = "MKS – Tenta"
2	Get	Device Type	UINT	999 = Vendor Specific
3	Get	Product Code	UINT	390
4	Get	Revision	STRUCT of:	See Below
		Major Revision	USINT	
		Minor Revision	USINT	
5	Get	Status	WORD	See Below
6	Get	Serial Number	UDINT	See Below
7	Get	Product Name	SHORT STRING	"DNI16AI"

Table 3. Common Services

Service Code	Class	Instance	Service Name
05 (0x05)	No	Yes	Reset
14 (0x0E)	Yes	Yes	Get_Attribute_Single

Table 4. Reset Service

Reset Value	Description
0	Reset device. Simulates recycling of the CPU power.
1	Reset device to "out-of-box" configuration, then reset device.

6.1.1 Revision – Attribute 4

MKS/CIT maintains strict revision control. The major revision number will increment as functional enhancements are implemented. The minor revision will increment if minor changes are incorporated.

6.1.2 Status – Attribute 5

Bit (s):	Called:	Definition
0	Owned	TRUE indicates the device has an owner. Within the Master/Slave paradigm the setting of this bit means that the Predefined Master/Slave Connection Set has been allocated to a master.
1		Reserved, set to 0.
2	Configured	TRUE indicates the application of the device has been configured to do something different than the "out–of–box" default. This does not include configuration of the communications.
3		Reserved, set to 0.
4, 5, 6, 7		Vendor-specific
8	Minor Recoverable Fault	TRUE indicates the device detected a problem with itself, which is thought to be

Bit (s):	Called:	Definition
		recoverable. The problem does not cause the device to go into one of the faulted states.
9	Minor Unrecoverable Fault	TRUE indicates the device detected a problem with itself, which is thought to be unrecoverable. The problem does not cause the device to go into one of the faulted states.
10	Major Recoverable Fault	TRUE indicates the device detected a problem with itself, which caused the device to go into the “Major Recoverable Fault” state.
11	Major Unrecoverable Fault	TRUE indicates the device detected a problem with itself, which caused the device to go into the “Major Unrecoverable Fault” state.
12, 13		Reserved, set to 0.
14, 15		Reserved, set to 0.

6.1.3 Serial Number – Attribute 6

The serial number is encoded in the product during the manufacturing cycle and is guaranteed to be unique across all product lines produced by MKS/CIT.

6.2 Router Object Class Code: 02 (0x02)

The Message Router Object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device. Class or Instance Attributes are not supported.

6.3 DeviceNet ObjectClass Code: 03 (0x03)

Table 5. Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	2

Table 6. Instance 1 Attributes

Attribute	Access	Name	Type	Value
1	Get/Set	MACID	USINT	See Below
2	Get/Set	Baud Rate	USINT	See Below
3	Get/Set	Bus Off Interrupt	BOOL	See Below
4	Get/Set	Bus Off Counter	USINT	See Below
5	Get	Allocation Information	STRUCT of	See Below
		Choice Byte	BYTE	
		Master Node Addr.	USINT	

Table 7. Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single
75 (0x4B)	No	Yes	Allocate Master/Slave
76 (0x4C)	No	Yes	Release Master/Slave

6.3.1 MACID – Attribute 1

The MACID is set using two BCD rotary switches located on the front panel. Valid MACID addresses are 0 to 63 (0 to 3F Hex). Setting the switch address to a value greater than 63 will disable the switch and allow software setting of the MACID. If the switches are set to a value greater than 63, then the MAC ID attribute is settable. The software setting defaults to the last hardware setting. The switch is only read during power up.

6.3.2 Baud Rate – Attribute 2

Settable only if the Baud Rate switch is set to a value greater than 2. Value returned would be switch value if less than 3 or the last value set.

Switch/Value	Speed
0	125 kbits
1	250 kbits
2	500 kbits
3	Software settable

6.3.3 Bus Off Interrupt – Attribute 3

Bus Off Interrupt (BOI) determines the action if a Bus Off state is encountered.

BOI Value	Action
0	Hold chip on OFF state (default)
1	Try to reset CAN controller.

6.3.4 Bus Off Counter – Attribute 4

Bus Off Counter will be forced to 0 whenever set, regardless of the data value provided.

6.3.5 Allocation Information – Attribute 5

Choice Byte

Bit	Description
7-2	Reserved. Always 0.
1	If set, polled I/O connection to be allocated.
0	If set, explicit message connection to be allocated.

6.4 Assembly Object Class Code: 04 (0x04)

The Assembly Objects bind attributes of multiple objects to allow data to or from each object to be sent or received over a single connection.

Table 8. Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	2
2	Get	Max Instance	UINT	2

Table 9. Instance 1 Attributes

Attribute	Access	Name	Type	Value
3	Get	Data	STRUCT of	
		Status	BYTE	See Configuration Object
		Temp	USINT	See Configuration Object
		Analog Inputs	UINT[ ]	See Analog Object

Table 10. Instance 2 Attributes

Attribute	Access	Name	Type	Value
3	Get	Data	STRUCT of	
		Range	BYTE [ ]	See Analog Object

Table 11. Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

Data Type of AIO

The data type of the analog inputs can either be INT or UINT. See the Analog Input Point object for the current setting.

The data type of the Range is Bytes. See the Analog Input Point object for the current setting.

Note **Assembly instance 1 is used to generate the poll response packet and assembly instance 2 is used to consume the poll request packet. See section 6.7 for custom poll configuration.**

6.4.1 Default Assembly Object Instance 1 and 2 Structure

The table below shows the format of Assembly instance 1 and 2 with the "out-of-box" attributes values of the Configuration object. The poll produce size is 34 bytes and the consume size is 2 bytes by default.

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1	0	Exception Status – See S-Device Supervisor Object							
	1	Temp – See Configuration Object							
	2	AI 0 – LSB							
	3	AI 0 – MSB							
	4	AI 1 – LSB							
	5	AI 1 – MSB							
	6	AI 2 – LSB							
	7	AI 2 – MSB							
	8	AI 3 – LSB							
	9	AI 3 – MSB							
	10	AI 4 – LSB							
	11	AI 4 – MSB							
	12	AI 5 – LSB							
	13	AI 5 – MSB							
	14	AI 6 – LSB							
	15	AI 6 – MSB							
	16	AI 7 – LSB							
	17	AI 7 – MSB							
	18	AI 8 – LSB							
	19	AI 8 – MSB							
	20	AI 9 – LSB							
	21	AI 9 – MSB							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	22	AI 10 – LSB							
	23	AI 10 – MSB							
	24	AI 11 – LSB							
	25	AI 11 – MSB							
	26	AI 12 – LSB							
	27	AI 12 – MSB							
	28	AI 13 – LSB							
	29	AI 13 – MSB							
	30	AI 14 – LSB							
	31	AI 14 – MSB							
	32	AI 15 – LSB							
	33	AI 15 – MSB							
2	0	Analog Input Range							
	1	Analog Input Range							

Connection Object Class Code: 05 (0x05)

The Connection Objects manage the characteristics of each communication connection. As a Group II Only Slave device the unit supports one explicit message connection and one poll I/O message connection.

Table 12. Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1

Table 13. Instance 1 Attributes (Explicit Connection)

Attribute	Access	Name	Type	Value
1	Get	State	USINT	See Below
2	Get	Instance Type	USINT	0 = Explicit Message
3	Get	Transport Class Trigger	USINT	0x83
4	Get	Produced Connection ID	UINT	See Below
5	Get	Consumed Connection ID	UINT	See Below
6	Get	Initial Comm. Char.	USINT	0x21
7	Get	Production Size	UINT	256
8	Get	Consumed Size	UINT	256
9	Get/Set	Expected Packet Rate	UINT	default 2500 msec
12	Get/Set	Watchdog Timeout Action	USINT	See Below
13	Get	Prod. Path Length	UINT	0
14	Get	Production Path		(null)
15	Get	Cons. Path Length	UINT	0
16	Get	Consumed Path		(null)

Table 14. Instance 2 Attributes (POLL connection)

Attribute	Access	Name	Type	Value
1	Get	State	USINT	See Below
2	Get	Instance Type	USINT	1 = I/O Message
3	Get	Transport Class Trigger	USINT	0x82
4	Get	Produced Connection ID	UINT	See Below
5	Get	Consumed Connection ID	UINT	See Below
6	Get	Initial Comm. Char.	USINT	0x01
7	Get	Production Size	UINT	See Below
8	Get	Consumed Size	UINT	See Below
9	Get/Set	Expected Packet Rate	UINT	0
12	Get/Set	Watchdog Timeout Action	USINT	See Below
13	Get	Prod. Path Length	UINT	6
14	Get	Production Path	STRUCT of	
		Log. Seg., Class	USINT	0x20
		Class Number	USINT	0x04
		Log.Seg., Instance	USINT	0x24

		Instance Number	USINT	0x100
		Log.Seg., Attribute	USINT	0x30
		Attribute Number	USINT	0x03
15	Get	Cons. Path Length	UINT	6
16	Get	Consume Path	STRUCT of	
		Log. Seg., Class	USINT	0x20
		Class Number	USINT	0x04
		Log.Seg., Instance	USINT	0x24
		Instance Number	USINT	0x101
		Log.Seg., Attribute	USINT	0x30
		Attribute Number	USINT	0x03

Table 15. Common Services

Service Code	Class	Instance	Service Name
05 (0x05)	Yes	Yes	Reset
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

6.4.2 State – Attribute 1

Connection State	Description
0	Non-Existent
1	Configuring
3	Established
4	Timed Out

6.4.3 Connection ID's – Attributes 4 and 5

Connection 1 Produced Connection ID: 10xxxxxx011
Connection 1 Consumed Connection ID: 10xxxxxx100

Connection 2 Produced Connection ID: 01111xxxxxx
Connection 2 Consumed Connection ID: 10xxxxxx101

Note **xxxxxx = Node Address.**

6.4.4 Production and Consumed Sizes – Attributes 7 and 8

The Production and Consumed sizes will change based on the Assembly instance are structured based on the Configuration Object. The Table below will define the maximum Production and Consumed sizes will their respective Assembly.

Assembly	Production Size	Consumed Size
1	34	
2		2

6.4.5 Watch Dog Timeout Activity – Attribute 12

Watchdog Timeout Value	Description
0	Timeout (I/O Messaging default)
1	Auto Delete (Explicit Messaging default)
2	Auto Reset
3	Deferred Delete

6.5 Analog Input Point Object Class Code: 10 (0x0A)

Table 16. Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	2
2	Get	Max Instance	UINT	8
6	Get	Max Class Attribute ID	UINT	7
7	Get	Max Instance Attribute ID	UINT	8

Table 17. Instance 1-8 Attributes

Attribute	Access	NV	Name	Type	Value
3	Get	V	Value	(See Value Data Type)	See Below
4	Get	V	Status	BOOL	0 = Okay 1 = Faulted
7	Get/Set	NV	Input Range	USINT	2 = 0V to 10V 6 = -5V to +5V
8	Get/Set	NV	Value Data Type	USINT	0 = INT 6 = UINT

Table 18. Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

6.5.1 Value – Attribute 3

The following table is a list of values based the Input Range attribute, Value Data Type attribute, and the resolution of the ADC being 12-bits.

Data Type	INT	UINT	INT	UINT
Range	**0V to 10V**	**0V to 10V**	**-5V to +5V**	**-5V to +5V**
-10V	0x0000	0x0000	0xF800	0x0000
-5V	0x0000	0x0000	0xF800	0x0000
0V	0x0000	0x0000	0x0000	0x0800
5V	0x0800	0x0800	0x07FF	0x0FFF
10V	0x0FFF	0x0FFF	0x07FF	0x0FFF

6.5.2 Status – Attribute 4

If the ±15V input power falls below tolerance, the analog input point's value will be indeterminist and the status will report as faulted. Also, if there is a bad read on the ADC, that channel will be faulted as well.

6.6 S-Device Supervisor Object Class Code: 48 (0x30)

Table 19. Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max Instance	UINT	1

Table 20. Instance 1 Attributes

Attribute	Access	NV	Name	Type	Value
3	Get	NV	Device Type	SHORT STRING	"ANALOG INPUT"
4	Get	NV	SEMI Standard Revision Level	SHORT STRING	"E54-0997"
5	Get	NV	Manufacturer's Name	SHORT STRING	"TENTA"
6	Get	NV	Manufacturer's Model Number	SHORT STRING	"DNI16AI"
7	Get	NV	Software Revision Level	SHORT STRING	1
8	Get	NV	Hardware Revision Level	SHORT STRING	1
9	Get	NV	Manufacturer's Serial Number	SHORT STRING	See Below
11	Get	V	Device Status	USINT	16 AIP
12	Get	V	Exception Status	BYTE	See Below
15	Get/Set	NV	Alarm Enable	BOOL	0=Disable, 1=Enable
16	Get/Set	NV	Warning Enable	BOOL	0=Disable, 1=Enable

Table 21. Common Services

Service Code	Class	Instance	Service Name
05 (0x05)	No	Yes	Reset

Service Code	Class	Instance	Service Name
06 (0x06)	No	Yes	Start
07 (0x07)	No	Yes	Stop
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

Table 22. Object-Specific Services

Service Code	Class	Instance	Service Name
75 (0x4B)	No	Yes	Abort
76 (0x4C)	No	Yes	Recover

nor revision.

6.6.1 Device Status – Attribute 11

Value	Description
1	Self Testing
2	Idle
3	Self-Test Exception
4	Executing
5	Abort
6	Critical Fault

6.6.2 Exception Status – Attribute 12

Bit	Function
0	ALARM/ device-common
1	ALARM/ device-specific
2	ALARM/ manufacturer-specific
3	Reserved – set to 0
4	WARNING/ device-common
5	WARNING/ device-specific
6	WARNING/ manufacturer-specific
7	1 == Expanded Method

6.7 Configuration Object Class Code: 100 (0x64)

Table 23. Class Attributes

Attribute	Access	Name	Type	Value
1	Get	Revision	UINT	1
2	Get	Max Instance	UINT	1

Table 24. Instance 1 Attributes

Attr	Access	NV	Name	Type	Value
1	Get	NV	Number of Inputs	USINT	15
2	Get	NV	Unit Temperature	SINT	Degrees C
3	Get	NV	PSV	UINT	
4	Get/Set	NV	Warning Temp Limit	SINT	60
5	Get/Set		Critical Temp Limit		70
6	Get		PSV Critical Limit	UINT	450

Table 25. Common Services

Service Code	Class	Instance	Service Name
05 (0x05)	No	Yes [2]	Reset
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

6.7.1 Reset Service

If a reset service is sent, then the attribute values will return to the “out-of-box” configuration.

7 Appendix A - Specifications

Physical Specifications

Criteria	Specifications
Dimensions	80mm (3.1496”) Height X 120mm (4.7244”) Width X 31mm (1.22”) Depth
I/O Connector	37-pin female D-sub
DeviceNet™ Connector	5-pin male microfast
Weight	200 g (0.44 lb)

Environmental Specifications

Criteria	Specifications
Operating Temperature	0 to +55°C
Storage	-40 to +85 °C
Humidity	5 to 95% non-condensing

Functional Specifications

Criteria	Specifications
BUS Interface	DeviceNet™
Front Panel Indicators	Network Status, Module Status
Rotary Switches	MAC ID and Baud Rate

Power Specifications

Criteria	Specifications
Input	Powered from DeviceNet™ +24VDC@120 mA min
Isolation	DC/DC Isolation

DeviceNet™ Specifications

Criteria	Specifications
Messaging	Explicit messaging
I/O	Polled I/O
Compliance	ODVA Semi SIG Compliant

Input/Output Specifications

Criteria	Specifications
Analog Input	16 points, single-ended 12-bit Software selectable range (0-10V), (–5 to +5V)

8 Warranty

MKS Instruments, Inc. (**MKS**) warrants that for one year from the date of shipment the equipment described above (the "equipment") manufactured by **MKS** shall be free from defects in materials and workmanship and will correctly perform all date-related operations, including without limitation accepting data entry, sequencing, sorting, comparing, and reporting, regardless of the date the operation is performed or the date involved in the operation, provided that, if the equipment exchanges data or is otherwise used with equipment, software, or other products of others, such products of others themselves correctly perform all date-related operations and store and transmit dates and date-related data in a format compatible with **MKS** equipment. THIS WARRANTY IS **MKS'** SOLE WARRANTY CONCERNING DATE-RELATED OPERATIONS.

For the period commencing with the date of shipment of this equipment and ending one year later, **MKS** will, at its option, either repair or replace any part which is defective in materials or workmanship or with respect to the date-related operations warranty without charge to the purchaser. The foregoing shall constitute the exclusive and sole remedy of the purchaser for any breach by **MKS** of this warranty.

The purchaser, before returning any equipment covered by this warranty, which is asserted to be defective by the purchaser, shall make specific written arrangements with respect to the responsibility for shipping the equipment and handling any other incidental charges with the **MKS** sales representative or distributor from which the equipment was purchased or, in the case of a direct purchase from **MKS**, with the **MKS-CIT** home office in San Jose, CA

This warranty does not apply to any equipment, which has not been installed and used in accordance with the specifications recommended by **MKS** for the proper and normal use of the equipment. **MKS** shall not be liable under any circumstances for indirect, special, consequential, or incidental damages in connection with, or arising out of, the sale, performance, or use of the equipment covered by this warranty.
THIS WARRANTY IS IN LIEU OF ALL OTHER RELEVANT WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTY AGAINST INFRINGEMENT OF ANY PATENT.